Electronic Version
Stylesheet Version v1.1.1

Claims

[c1] What is claimed is:

1. A hydrodynamic bearing comprising:
a shaft;
a top plate fixed to the upper section of the shaft, the top plate having an ring-shaped portion extended in a lower direction;
a sleeve that rotates relative to the shaft about a rotation axis;
a bottom plate fixed to the lower section of the sleeve;
a bearing section including a minute gap formed between the upper end face of the sleeve and the lower end face of the top plate, a lubricating fluid retained in the minute gap and dynamic pressure generating grooves formed on at least one of the upper end face of the sleeve and the lower end face of the top plate, that induce dynamic pressure in the lubricating fluid when the shaft or the sleeve rotates relatively; and
a capillary seal section adjoining the bearing section, having a radial gap between an outer peripheral face of the sleeve and an inner peripheral face of the ring-shaped portion , wherein the dimension of the radial gap at an observing point is getting at least wider in accor-

dance with an increase in the distance from the bearing section to the observing point in the rotation axis;
wherein the bearing section supports the shaft and the sleeve so as to rotate relative to the rotation axis,
the lubricating fluid is continuously retained from the bearing section to the capillary seal section and forms a vapor-liquid face within the capillary seal section, and
the minimum value of radial-direction distances between the inner peripheral surface of the ring-shaped portion and the rotation axis is set as R1, and
a radial-direction distance from an inner point on a boundary between the vapor-liquid face of the lubricating fluid and the outer peripheral face of the sleeve, to the rotation axis is set as R2, and
the minimum value R1 and the radial-direction distance R2 have a relation R1 > R2.

[c2] 2. A hydrodynamic bearing according to Claim 1, wherein, a center axis line of the radial gap composing the capillary seal section is defined as M and a radial-direction plane that is perpendicular to the rotation axis is defined as Y, and the inner point on the boundary between the vapor-liquid face of the lubricating fluid and the outer peripheral face of the sleeve is a position where the center axis line M and the radial-direction plane Y crosses each other.

[c3] 3. A hydrodynamic bearing according to Claim 1, wherein the capillary seal section comprising:
a first capillary seal section adjoining the bearing section, having a first radial gap between the outer peripheral face of the sleeve and a first inner peripheral face of the ring-shaped portion, a dimension of the first radial gap being getting at least wider in accordance with increasing a distance from the bearing section in the rotation axis, and
a second capillary seal section adjoining the first capillary seal section, having a second radial gap between the outer peripheral face of the sleeve and a second inner peripheral face of the ring-shaped portion, a dimension of the second radial gap being getting at least wider in accordance with increasing the distance from the bearing section in the rotation axis;
wherein a first radial distance between the first inner peripheral face and the rotation axis in radial direction, is getting at least shorter in accordance with increasing the distance from the bearing portion in the rotation axis, and the first inner peripheral face forms a first angle θ_1 (employing a smaller angle having the angle value in a range $0 \leq \theta_1 \leq 90°$) with respect to the rotation axis, and a second radial distance between the second inner peripheral face and the rotation axis in radial direction, is

getting at least shorter in accordance with increasing the distance from the bearing portion in the rotation axis, and the second inner peripheral face forms a second angle θ_2 (employing a smaller angle having the angle value in a range $0 \leq \theta_2 \leq 90°$) with respect to the rotation axis, the first angle θ_1 and the second angle θ_2 takes a relationship of $\theta_1 > \theta_2$.

[c4] 4. A hydrodynamic bearing according to Claim 4, wherein the second angle θ_2 is $\theta_2 > 0$.

[c5] 5. A hydrodynamic bearing according to Claim 5, wherein the first angle θ_1 is $\theta_1 > 0$.

[c6] 6. A manufacturing method of the hydrodynamic bearing according to Claim 1 comprising:
a step of measuring a filling amount of the lubricating fluid by observing the inner point of the lubricating fluid from a position immediately above the inner point in a direction approximately parallel to the rotation axis; and
a step of adjusting the filling amount of the lubricating fluid.

[c7] 7. A manufacturing method of the hydrodynamic bearing according to Claim 7, wherein
a step of setting the inner point on the boundary between the vapor-liquid face of the lubricating fluid and

outer peripheral face of the sleeve for measuring the radial-direction distance R2 from the inner point to the rotation axis; and
a step of adjusting the filling amount of the lubricating fluid by adjusting the inner point on the boundary obtained by the measuring step to a preset position.

[c8] 8. A manufacturing method of the hydrodynamic bearing according to Claim 7, comprising:
a step of, when the center axis line of the radial gap composing the capillary seal section is defined as M and a radial-direction plane perpendicular to the rotation axis is defined as Y, setting the inner point to a position where the rotation axis M and the radial-direction plane Y cross each other, thereby measuring the inner point; and
a step of adjusting the vapor-liquid face of the lubricating fluid in the inner point obtained by the measuring step to a preset position, thereby adjusting the filling amount of the lubricating fluid.

[c9] 9. A spindle motor comprising:
a shaft;
a top plate fixed to the upper section of the shaft, the top plate having an ring-shaped portion extended in a lower direction;
a sleeve that rotates relative to the shaft about a rotation

axis;
a bottom plate fixed to the lower section of the sleeve;
a bearing section including a minute gap formed between the upper end face of the sleeve and the lower end face of the top plate, a lubricating fluid retained in the minute gap and dynamic pressure generating grooves formed on at least one of the upper end face of the sleeve and the lower end face of the top plate, that induce dynamic pressure in the lubricating fluid when the shaft or the sleeve rotates relatively; and
a capillary seal section adjoining the bearing section, having a radial gap between an outer peripheral face of the sleeve and an inner peripheral face of the ring-shaped portion , wherein the dimension of the radial gap at an observing point is getting at least wider in accordance with an increase in the distance from the bearing section to the observing point in the rotation axis;
a stator supported by the bottom plate; and
a magnet supported by the top plate for producing rotational magnetic field with the stator;
wherein the bearing section supports the shaft and the sleeve so as to rotate relative to the rotation axis,
the lubricating fluid is continuously retained from the bearing section to the capillary seal section and forms a vapor-liquid surface within the capillary seal section, and
the minimum value of radial-direction distances between

the inner peripheral surface of the ring-shaped portion and the rotation axis is set as R1, and
a radial-direction distance from an inner point on a boundary between the vapor-liquid face of the lubricating fluid and the outer peripheral face of the sleeve, to the rotation axis is set as R2, and
the minimum value R1 and the radial-direction distance R2 have a relation R1 > R2.

[c10] 10. A spindle motor according to Claim 9, wherein, a center axis line of the radial gap composing the capillary seal section is defined as M and a radial-direction plane that is perpendicular to the rotation axis is defined as Y, and the inner point on the boundary between the vapor-liquid face of the lubricating fluid and the outer peripheral face of the sleeve is a position where the center axis line M and the radial-direction plane Y crosses each other.

[c11] 11. A spindle motor to Claim 9, wherein the capillary seal section comprising:
a first capillary seal section adjoining the bearing section, having a first radial gap between the outer peripheral face of the sleeve and a first inner peripheral face of the ring-shaped portion, a dimension of the first radial gap being getting at least wider in accordance with increasing a distance from the bearing section in the rota-

tion axis, and

a second capillary seal section adjoining the first capillary seal section, having a second radial gap between the outer peripheral face of the sleeve and a second inner peripheral face of the ring-shaped portion, a dimension of the second radial gap being getting at least wider in accordance with increasing the distance from the bearing section in the rotation axis;

wherein a first radial distance between the first inner peripheral face and the rotation axis in radial direction, is getting at least shorter in accordance with increasing the distance from the bearing portion in the rotation axis, and the first inner peripheral face forms a first angle θ_1 (employing a smaller angle having the angle value in a range $0 \leq \theta_1 \leq 90°$) with respect to the rotation axis, and a second radial distance between the second inner peripheral face and the rotation axis in radial direction, is getting at least shorter in accordance with increasing the distance from the bearing portion in the rotation axis, and the second inner peripheral face forms a second angle θ_2 (employing a smaller angle having the angle value in a range $0 \leq \theta_2 \leq 90°$) with respect to the rotation axis, the first angle θ_1 and the second angle θ_2 takes a relationship of $\theta_1 > \theta_2$.

[c12] 12. A spindle motor according to Claim 11, wherein the

second angle θ_2 is $\theta_2 > 0$.

[c13] 13. A spindle motor according to Claim 12, wherein the first angle θ_1 is $\theta_1 > 0$.

[c14] 14. A manufacturing method of the spindle motor according to Claim 9 comprising:
a step of measuring a filling amount of the lubricating fluid by observing the inner point from a position immediately above the inner point in a direction approximately parallel to the rotation axis; and
a step of adjusting the filling amount of the lubricating fluid.

[c15] 15. A manufacturing method of the spindle motor according to Claim 14, wherein
a step of setting the inner point on the boundary between the vapor-liquid face of the lubricating fluid and outer peripheral face of the sleeve for measuring the radial-direction distance R2 from the inner point to the rotation axis; and
a step of adjusting the filling amount of the lubricating fluid by adjusting the inner point on the boundary obtained by the measuring step to a preset position.

[c16] 16. A manufacturing method of the spindle motor according to Claim 14, comprising:

a step of, when the center axis line of the radial gap composing the capillary seal section is defined as M and a radial-direction plane perpendicular to the rotation axis is defined as Y, setting the inner point to a position where the rotation axis M and the radial-direction plane Y cross each other, thereby measuring the inner point; and

a step of adjusting the vapor-liquid face of the lubricating fluid in the inner point obtained by the measuring step to a preset position, thereby adjusting the filling amount of the lubricating fluid.

[c17] 17. A disk drive device to which a disc-like recording medium, that can record information, is mounted, comprising:

a housing;

a spindle motor fixed in the housing for rotating the recording medium; and

means for writing or reading information to or from a required position on the recording medium; wherein the spindle motor comprising:

a shaft;

a top plate fixed to the upper section of the shaft, the top plate having an ring-shaped portion extended in a lower direction;

a sleeve that rotates relative to the shaft about a rotation

axis;
a bottom plate fixed to the lower section of the sleeve;
a bearing section including a minute gap formed between the upper end face of the sleeve and the lower end face of the top plate, a lubricating fluid retained in the minute gap and dynamic pressure generating grooves formed on at least one of the upper end face of the sleeve and the lower end face of the top plate, that induce dynamic pressure in the lubricating fluid when the shaft or the sleeve rotates relatively; and
a capillary seal section adjoining the bearing section, having a radial gap between an outer peripheral face of the sleeve and an inner peripheral face of the ring-shaped portion , wherein the dimension of the radial gap at an observing point is getting at least wider in accordance with an increase in the distance from the bearing section to the observing point in the rotation axis;
a stator supported by the bottom plate; and
a magnet supported by the top plate for producing rotational magnetic field with the stator;
wherein the bearing section supports the shaft and the sleeve so as to rotate relative to the rotation axis,
the lubricating fluid is continuously retained from the bearing section to the capillary seal section and forms a vapor-liquid surface within the capillary seal section, and
the minimum value of radial-direction distances between

the inner peripheral surface of the ring-shaped portion and the rotation axis is set as R1, and

a radial-direction distance from an inner point on a boundary between the vapor-liquid face of the lubricating fluid and the outer peripheral face of the sleeve, to the rotation axis is set as R2, and

the minimum value R1 and the radial-direction distance R2 have a relation $R1 > R2$.